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Cuora galbinifrons (s. l.) is now known to range from Vietnam (Bourret 1939, 1941; Petzold 1963, 1965; Felix 1965), southwestern China (Guangxi Prov., Xiadong village [22°12′N/108°43′E], Qiu Prefecture; Liu and Zhang 1987, Buskirk 1989), and southeastern (Li 1958; location verified by Zhao, pers. comm. to J. R. Buskirk) and southwestern Hainan Island (Tungfang [19°03′N/108°56′E], Kancheng [18°51′N/108°37′E], and Huangliu [18°30′N/

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108°46'E]; Weiss 1989). However, in 1988 Hong Kong animal dealer Oscar Shiu sent us several unique serrate-shelled "*C. galbinifrons*" from central Hainan Island (Fig. 1). Closer examination revealed several other distinctive morphological and color characters. In addition, discriminant function analysis of mensural data (method in McCord & Iverson 1991) from 29 specimens from Vietnam and western and central Hainan revealed that these turtles were morphometrically distinct as well (Figs. 2 and 3).

Drawing attention to the distinctive serrate rear margin of its carapace, we name this new form

Cuora galbinifrons serrata,
new subspecies
Serrate Indochinese Box Turtle
Fig. 1, right

Holotype.—UF 81791, an adult male, preserved in alcohol; collected 100 km east of Tungfang at Tainhfien in central Hainan Island, China; purchased from local people by Mr. Oscar Shiu, in the summer of 1988.

Allotype.—USNM 314208, an adult female, preserved in alcohol; same data as holotype.

Paratypes.—UF 81792–97 (all in alcohol), one adult female, two adult males, two subadults (apparently females), and one yearling; and UF 81798 (complete skeleton), an adult male; all with same data as holotype.

Diagnosis.—A subspecies of *Cuora galbinifrons* with a serrate posterior carapacial margin (a smooth margin in all other populations); a distinctly tricarinate carapace even in adults (usually smooth to weakly tricarinate in others); mostly black pleural scutes streaked with lighter color (mostly light colored pleural scutes streaked with black in others); obvious growth laminae on the carapacial and plastral scutes even in adults (usually smooth, particularly on the plastron, in old adults in others); a plastron with abundant light pigment, never all black (variable, frequently all black in others); a gular scute that becomes slightly notched medially in large adults (almost never so notched in others); a relatively long interhumeral seam (mean, 42% of interpectoral seam length; 22% in other populations); an interanal seam 70–90% complete (usually absent in others); and a dark-bordered elongated yellow blotch between the eye and tympanum (blotch indistinct if present at all in others).

Description (based on all nine types).—Carapace length (CL) to at least 194 mm in males and at least 179 mm in females, shell elliptical, moderately tricarinate and domed (maximum shell height/CL = 0.42 to 0.48; mean = 0.46), widest at the level of marginal M7 or 8 (maximum carapace width/CL = 0.70 to 0.81; mean = 0.75), with a serrate posterior margin (even in the yearling), and with moderately obvious growth annuli. M1 longest; M7, 8, and 9 next longest, coequal; M11 smallest; M7 tallest; M3–5 and M8–12 distinctly flared. Cervical scute small, generally rectangular, but wider posteriorly than anteriorly, and longer than wide. Vertebrals V1–V5 wider than long; V1 not contacting M2; V5 not contacting M10. Medial keel least pronounced on V5; keel marked with black-bordered yellow to yellow-brown line. Lateral keels most pronounced on pleural P3; keels marked with narrow yellow to yellow-brown line bordered medially with black pigment. Carapace dark brown with black markings to nearly all black. Ventral surface of each marginal highly variable in color, from all black to mostly

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Fig. 1. Comparisons of *Cuora galbinifrons* from Vietnam (left; UF 81774), western coastal Hainan Island (center; UF 81781), and central Hainan Island (right; UF 81792).

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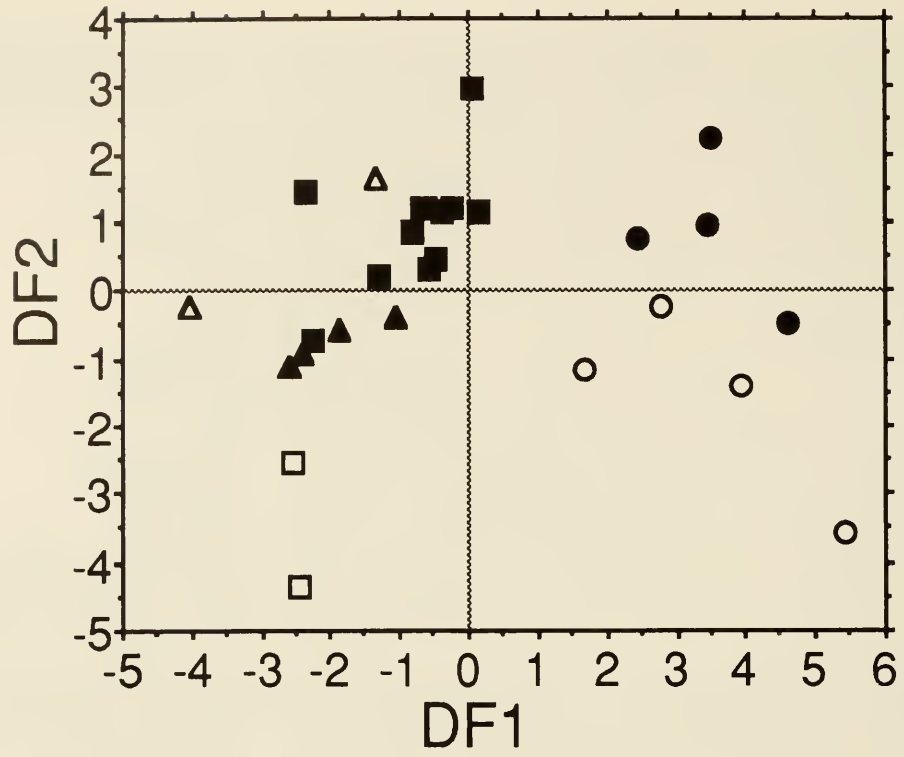

Fig. 2. Discriminant function plot of populations and sexes of *Cuora galbinifrons* from Vietnam (squares), western coastal Hainan Island (triangles), and central Hainan Island (dots) based on 12 morphometric characters (as in McCord and Iverson 1991, except not bridge length). First axis accounts for 58.3% of variation; second, 20.1%. Open symbols are males and solid symbols are females.

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Maximum plastron length (PL) approximately equal to carapace length (PL/CL = 0.96–1.03; mean = 1.00). Plastron slightly upturned anteriorly, with obvious hinge present between pectoral and abdominal scutes. Plastral forelobe width (PW1) at level of junction of humeropectoral seam and lateral plastral margin 48 to 51% (mean = 49%) of maximum plastron length (PL). Anterior width of plastral hindlobe (PW3: at lateral junction of abdominofemoral seam) 56 to 59% (mean = 58%) of maximum plastron length. Plastral hindlobe (HL) without an anal notch (medial length of HL 56 to 59% of maximum plastron length; mean = 57%). Bridge moderately long (bridge length/PL = 0.31 to 0.36, mean = 0.34); no axillary scute present; small inguinal scute present on yearling, lost in larger specimens. Average plastral formula: interabdominal seam (IAB) > interanal seam (IAN) > interpectoral seam (IP) ≫ intergular seam (IG) ≫ interfemoral seam (IF) ≥ interhumeral seam (IH). Interhumeral seam length/interpectoral length = 0.31 to 0.53 (mean = 0.42); interfemoral seam length/interanal length = 0.27 to 0.61 (mean = 0.39). A black blotch covering 20 to 50% of each plastral scute in adults, primarily on the older portion of the scute; blotches less extensive in subadults.

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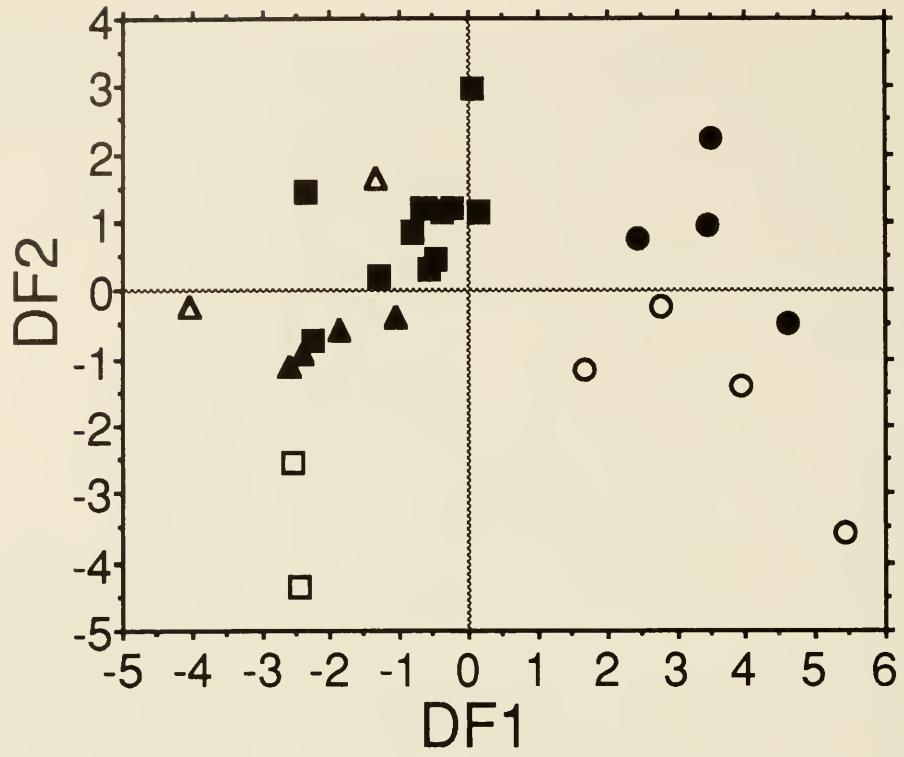

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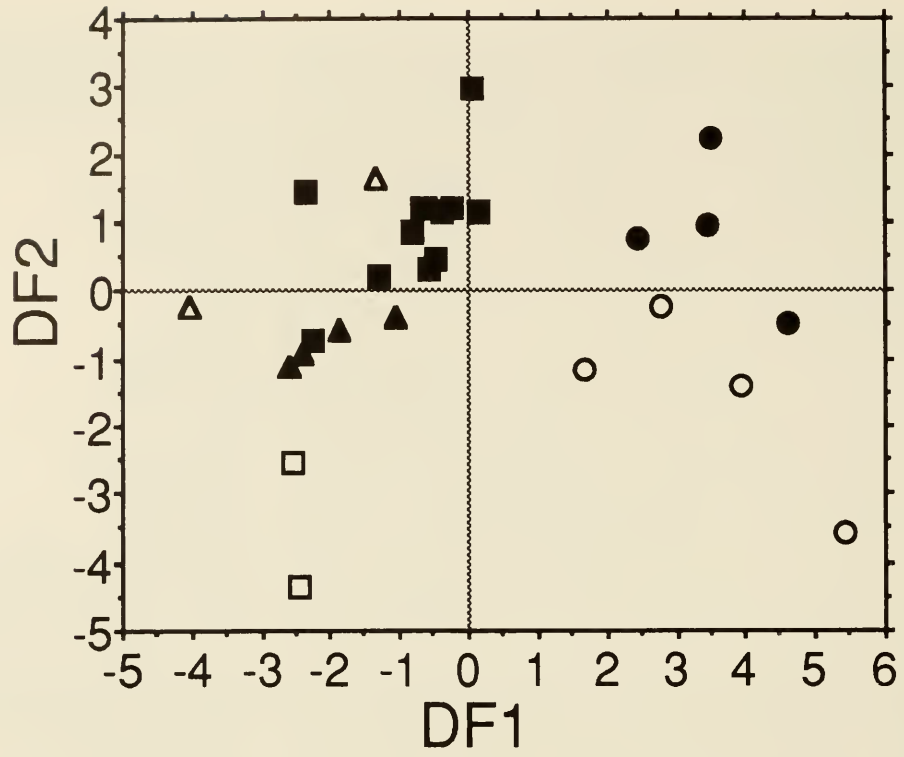

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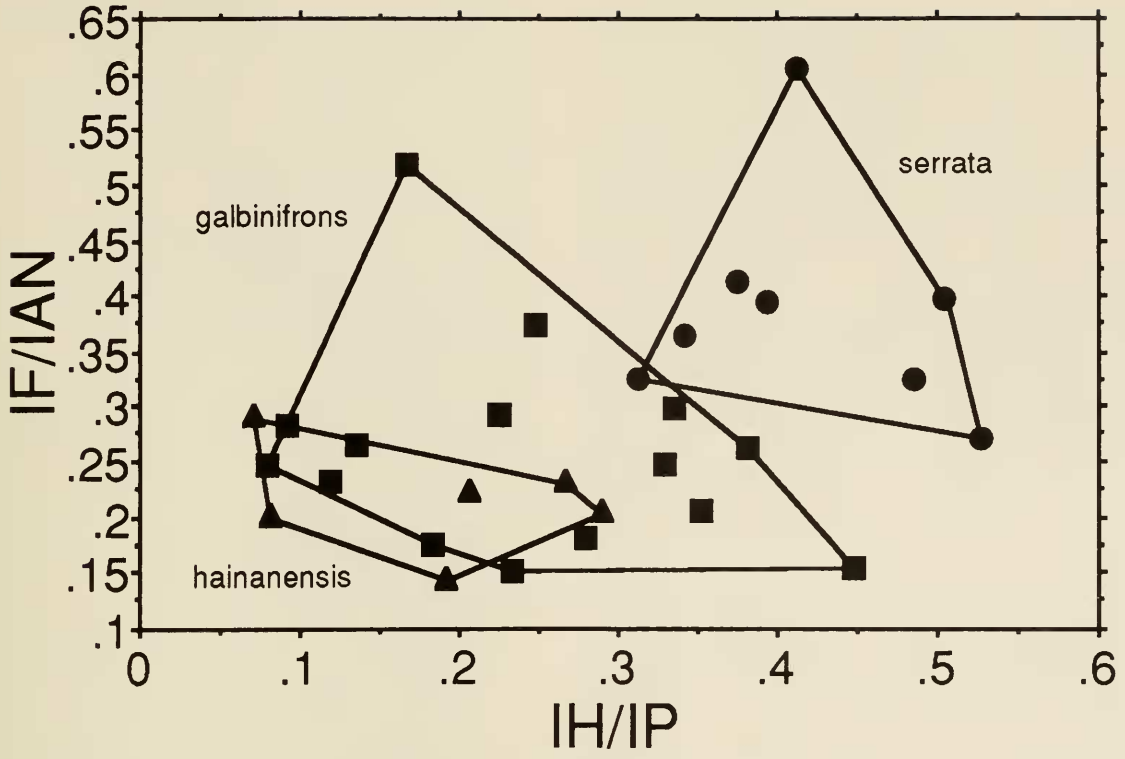


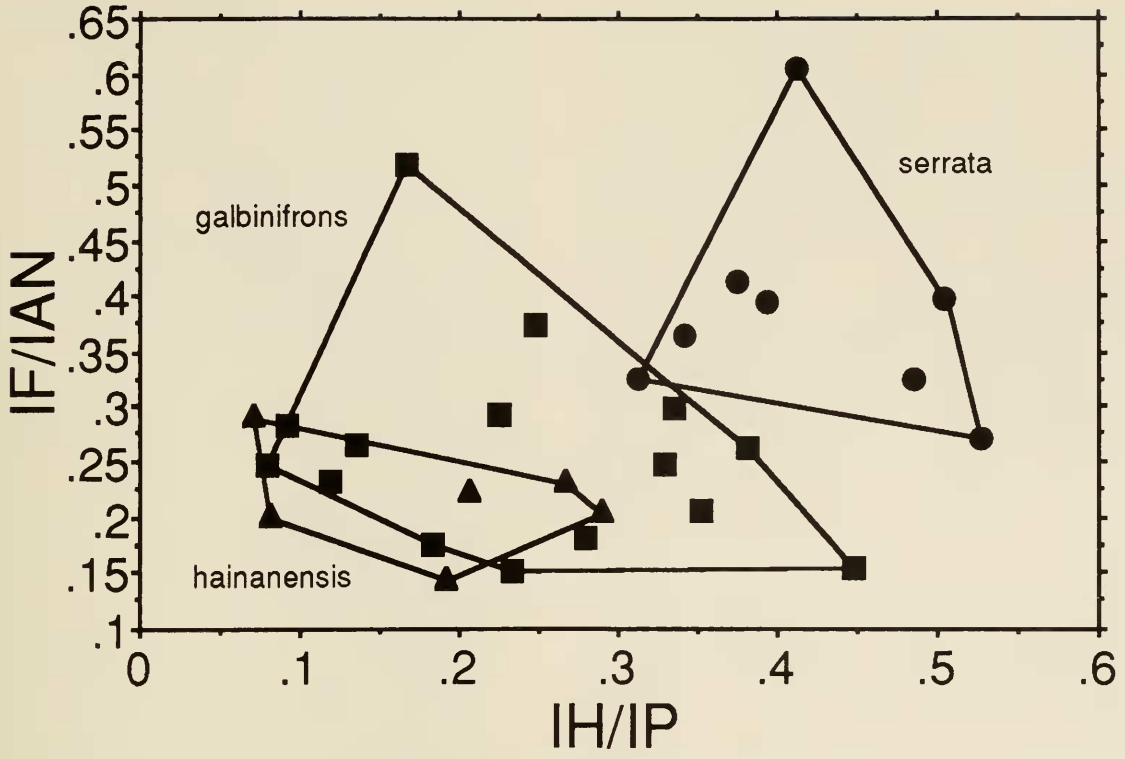
Fig. 3. Bivariate plot of the relationships among populations (sexes combined) of *Cuora galbinifrons* based on the characters IH/IP (interhumeral seam length/interpectoral length) and IF/IAN (interfemoral seam length/interanal length). Squares are *Cuora g. galbinifrons* (North Vietnam); triangles are *Cuora g. hainanensis* (western coastal Hainan Island); circles are *Cuora g. serrata* (central Hainan Island). Polygons connect most dispersed individuals of each taxon.

Antebrachium covered with large, imbricate scales, none particularly sickle-shaped; largest scales on hindlimb at heel, but much smaller than largest forelimb scales. Upper parts of limbs and tail covered with scales of medium size. Tail not particularly long, though slightly longer in males than females; base of tail thicker in males than females.

Distribution.—Known only from the type locality.

Natural history.—The medial length of the single distinct abdominal scute annulus of the smallest paratype (CL = 66 mm; PL = 61.5 mm), suggests that hatchling size was about 51 mm PL.

Remarks.—Although no specimens of *Cuora galbinifrons* were available to us from southeastern Hainan Island, descriptions of the nine types of *hainanensis* by Li (1958), Zhao (*in* Hu et al. 1975), and Koshikawa (1982) clearly indicate that those turtles are very different from *C. g. serrata* and probably identical to those on western Hainan. Specifically, southeastern Hainan turtles have no serrated shell margin, the shortest plastral scute being the humeral (often the femoral in *C. g. serrata*), no interanal seam, very little yellow pigment on the plastron, and "chestnut brown" markings on the carapace. Each of these traits clearly distinguishes them from *C. g. serrata*. In addition, Vietnam specimens of *C. galbinifrons* typically have a shell with a beige to yellow brown background, whereas those from western Hainan typically have an orange to red or pink background (Weiss 1989; this study). Although there is some uncertainty as to the exact translation of "chestnut brown" (Koshikawa 1982), that color is certainly more red than beige or yellow. Thus, specimens from southeastern and western Hainan may be indistinguishable, but direct examination of the type material of *C. hainanensis* will be necessary to confirm this hypothesis.



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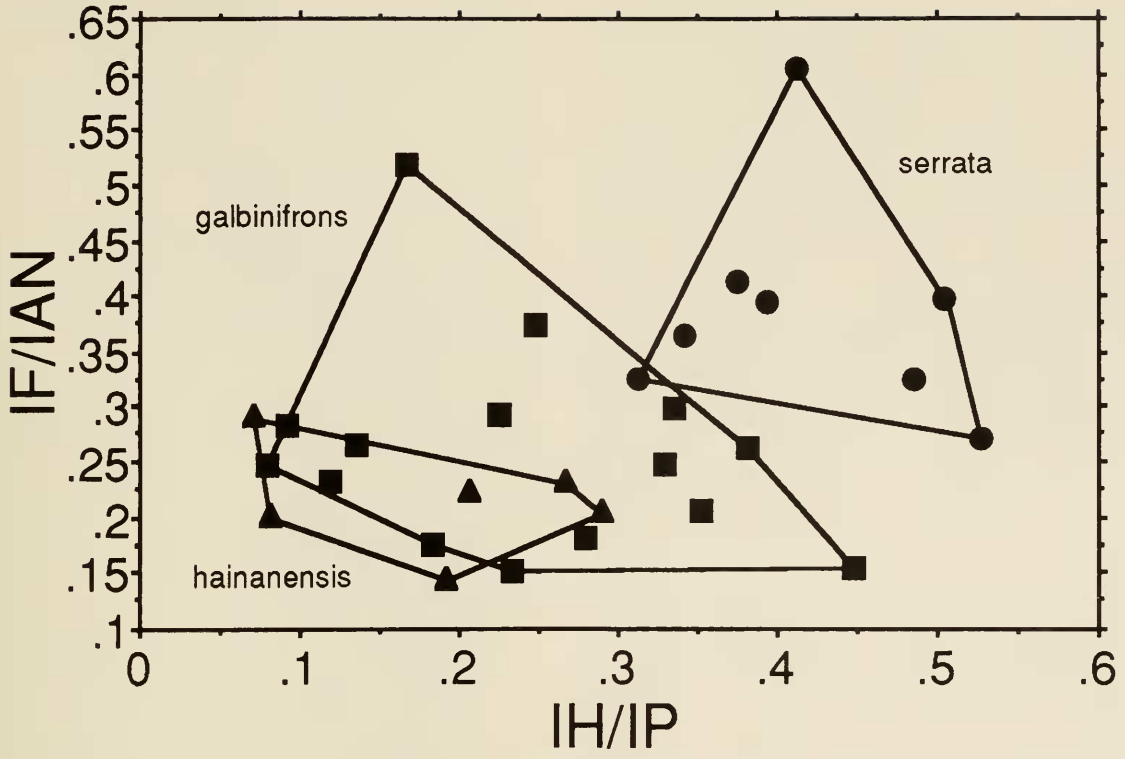

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The taxonomic relationship between Vietnam and non-serrate Hainan Island specimens is also unclear. Morphometrically, non-serrate western Hainan specimens tend to have a slightly longer plastral hindlobe, a slightly shorter interhumeral seam, and slightly longer interpectoral and interabdominal seams than Vietnam specimens, but only the difference in hindlobe length approaches statistical significance. The discriminant function analysis (Fig. 2) also demonstrates the morphometric similarity of the populations of non-serrated turtles. However, because of the color differences mentioned above, and until more material is available for study, we recommend recognizing the non-serrate specimens from Hainan Island as *C. g. hainanensis* and those from Vietnam as the nominate subspecies.

Specimens examined.—*Cuora g. galbinifrons*: North Vietnam (UF 78564–68, 78570–73, 81774–80, 81787–90; WPM 1, alive). *Cuora g. hainanensis*: China, Hainan Island, western coastal area (UF 81781–86; WPM 1, alive). *Cuora g. serrata*: China, central Hainan Island (UF 81791–98; USNM 314208).

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